* NOTICES *

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention is used for the material for car bodies of an automobile etc., and relates to suitable tailored blank material and its manufacture approach.
[0002]
[Description of the Prior Art] In recent years, in the auto industry, environmental preservation (lightweight-izing) and insurance are made into a keyword, and car-body development is furthered. In order to aim at improvement in fuel consumption, securing crew's insurance about the car body of an automobile especially, much more lightweight-ization is advanced, and since a material, structure, the assembly construction approach, etc. are various, various examination is performed.
[0003] For example, what generally carried out weldbonding of the steel plate with which board thickness differs from a steel type about the tailored blank material which is a material for press forming of a car body, and was made into desired magnitude is used abundantly. High tensile steel and the thick steel plate of board thickness are arranged only into the part which needs reinforcement, or a rust-proofing steel plate is arranged only into the part which needs corrosion resistance, and this can arrange mild steel, the thin steel plate of board thickness, etc. into other parts, and since it can plan large cost reduction, it comes out. And application on the thick material components such whose tailored blank material is not only the car body of an automobile but the circumference components of a guide peg is also being considered.
[0004] By the way, the above-mentioned tailored blank material was conventionally manufactured by the laser-welding method or the mush-seam-welding method.
[0005] The heat distortion at the time of welding is small, since it is high energy consistency welding, deep penetration is acquired, and high-speed welding is possible for the above-mentioned laser-welding method. And the laser beam is condensed so that the beam diameter on a rat tail, usual, and a work piece may be set to 1mm or less with a lens. For this reason, a high comparison precision is required of the junction end face for [that] butt welding. However, when a material is the sheet steel of less than about 2mm of board thickness, since the precision of Shache of flexibility and the Shache amputation stump side is bad, the comparison precision of a junction end face is inferior, and it is easy to generate a weld flaw in the cutting. Moreover, the focus of a beam and a gap of an aim location cause poor welding, and make joint reinforcement produce dispersion. Therefore, by the laser-welding method, **** processing of the Shache amputation stump side of sheet steel was performed, the comparison precision of a junction end face was raised, or since the focus of a beam and an aim location needed to be managed highly precise, productivity was inferior, and there was a problem that the manufacturing cost of a product increased.
[0006] On the other hand, compared with a laser-welding method, the installation cost of mush seam welding is cheap, and is economical. Moreover, since the configuration of the weld zone is superposition welding, it has the advantage that highly-precise-izing of the Shache amputation stump side of material sheet steel is completely unnecessary. However, since there was a level difference

resulting from superposition, there was a problem that an appearance configuration was bad in the weld zone.
[0007] furthermore, the above -- when any welding process tended to carry out high-speed welding of the tailored blank material for thick material (about 2-7mm of board thickness) components, such as circumference components of a guide peg of an automobile, and it was going to manufacture it in high efficiency, there was the following problem.
[0008] That is, in laser welding, in addition to the problem of the above-mentioned matching precision, since board thickness is thick, the laser-welding machine of a bigger output is required to realize high-speed welding, and an installation cost becomes high. Moreover, it is necessary to manage the focus and aim location of a beam from the case where board thickness is thin, to nearby high degree of accuracy, and the further fall of productivity is not avoided.
[0009] On the other hand, in mush seam welding, in order to make enough nuggets for the lap-welding section form, it is necessary to enlarge welding pressure and welding heat input, enhancement of a facility is needed, and an installation cost becomes high. Moreover, if a board thickness difference is large, the calorific value in the steel plate by the side of a thick plate will become large, a nugget will be formed in the location which inclined toward the steel plate side by the side of a thick plate rather than the junction interface, and the product which has the stable joint reinforcement will no longer be obtained. Furthermore, the level difference resulting from superposition becomes larger.
[0010]
[Problem(s) to be Solved by the Invention] Without there being no level difference resulting from superposition, and performing **** processing to the steel plate end face of the stable joint reinforcement, the tailored blank material equipped with the weldbonding section which has the outstanding moldability, and a material, even if the purpose of this invention is heavy-gage tailored blank material, it is to offer the manufacture approach which can be manufactured in high efficiency.
[0011]
[Means for Solving the Problem] The summary of this invention is in the tailored blank material of following (1), and its manufacture approach of following (2).
[0012] (1) It is the tailored blank material for press forming to which both steel plates compared and weldbonding was carried out, and is the board thickness of one steel plate t1 It is the board thickness of the steel plate of (mm) and another side t2 Tailored blank material which has the joint width of face W which fills the following ** type when joint width of face after (mm) (however, t1 <=t2) reinforcement bead removal is set to W (mm).
[0013] W/t 1 < 300 .... ** (2) board thickness is t1. The steel plate of (mm), and t2 The steel plate of (mm) After comparing both the end faces of the steel plate of two sheets of (t1 <=t2 [however,]), The manufacture approach of tailored blank material given in the above (1) using the thing of the board width with which the board width Wh of the comparison edge (mm) fills the following ** type to one [at least] steel plate in case direct-current butt welding of the comparison section is carried out.
[0014] Wh/t 1 < 300 .... In the approach of this invention the ** above (2), it can be desirable to carry out direct-current butt welding of that comparison section on the conditions with which following ** - ** type are filled, and it can raise the moldability of the weldbonding section further in this case.
[0015]
I/Waxt 1<=250 (A/mm2) ... **I/Waxt 2>=100 (A/mm2) ... **S<=0.8 ..... ** -- here, it is the target joint width-of-face (mm) S:resistance welding time after I:(welding current A) Wa:reinforcement bead removal (second).
[0016] The above (1) and (2) were made to complete this invention of a publication based on the following knowledge. That is, in the auto industry, it was adopted as manufacture of wheel rim material from the former, and butt welding in a short time was possible, and a flash plate was not generated at all at the time of welding, but this invention persons tried various experiments paying attention to the direct-current butt welding method (henceforth DC butt welding method) for having the property that moreover a high matching precision is not required of a junction end face, in order to attain the above-mentioned purpose. Consequently, the knowledge of the following thing was carried out.

[0017] If the joint width of face W after reinforcement bead removal fills the above-mentioned ** type, the joint engine performance of the weldbonding section will be stabilized and the tailored blank material which has the weldbonding section with a good moldability will be obtained.
[0018] Moreover, that tailored blank material is obtained only by comparing and carrying out DC butt welding of both the end faces of this steel plate using the steel plate of two sheets which fills the above-mentioned ** type. If DC butt welding is carried out on the conditions with which above ** - ** type are filled in that case, the increase of the stability of the joint engine performance of the weldbonding section and a moldability will improve further.
[0019] In addition, conventionally, DC butt welding method was applied to butt welding of the same board thickness material, and was not applied to butt welding of difference thickness material.
[0020]
[Embodiment of the Invention] Hereafter, the tailored blank material and its desirable manufacture approach of this invention are explained to a detail with reference to an accompanying drawing.
[0021] Drawing 1 is the thickness t1 with thin board thickness [that Shache cutting is carried out by DC butt welding method]. Thickness t2 with thick steel plate (it is hereafter described as sheet steel) 1 and board thickness It is drawing of longitudinal section showing the welding mode in the case of manufacturing the difference thickness tailored blank material which consists of a steel plate (it is hereafter described as a steel plate) 2.
[0022] As shown in drawing, an inferior surface of tongue is arranged, both end faces are compared, and sheet steel 1 and a steel plate 2 are clamped free [sliding] with the electrodes 3 and 3 with which it has been arranged near [the] the end face up and down. Subsequently, after impressing a direct current to electrodes 3 and 3, from a longitudinal direction, upsetting-force P is added and butt welding is carried out.
[0023] Drawing 2 shows the longitudinal-section configuration of the joint by which butt welding was carried out, and the reinforcement bead 5 which consists of molten metal coagulation section 4b which the lower right attaches ****** and a joint 4 indicates to be heat affected zone 4a the lower left attaches and indicates ****** to be all over drawing all over drawing, and consists of a part of heat affected zone 4a and all of molten metal coagulation section 4b is formed in the both sides of vertical both sides of the direction of board thickness, and the direction of the board width.
[0024] As shown in drawing 3 and drawing 4 , the above-mentioned reinforcement bead 5 is removed by proper means, such as grinding and cutting, and let it be a predetermined difference thickness tailored blank material product.
[0025] The value t1 with which ** type which mentioned above the joint width of face W (refer to drawing 4) after removing the reinforcement bead 5 in this invention at this time is filled, i.e., board thickness of sheet steel 1, It is necessary to make it less than 300 times. The reason is as follows.
[0026] Cutting processing and press-forming processing are performed also to the joint 4, and, as for the difference thickness tailored blank material of above-mentioned this invention, the joint 4 is usually asked for the good moldability for press-forming processing.
[0027] However, the end face of welding materials-ed (sheet steel 1 and steel plate 2) is heated by DC butt welding method's resistance generation of heat on the basis of the contact location of a junction end face. Since it is the conjugation method which adds upsetting-force P from comparison after the whole junction end face is heated soon, in order to obtain the joint 4 which has the stable joint engine performance, it is necessary to make the distribution condition of the resistance exoergic location in early stages of energization, and the pressurization condition of a junction end face into homogeneity.
[0028] However, it is the board thickness t1 of sheet steel 1 about the joint width of face W. Since the board width to board thickness is too large when it is made 300 or more times The resistance exoergic location in early stages of energization comes to vary greatly in the direction of the board width, and an underheat field and a fault heating field are generated in a junction end face. Since the joint on-the-strength fall part by the lack of an upset occurs in a **** part and the latter fault heating field in the former underheat field and these parts break at the time of press forming (simple bending shaping), it becomes impossible to secure a good moldability.

[0029] Therefore, in this invention, it set like ** type which mentioned above the joint width of face W after reinforcement bead removal.
[0030] In addition, especially the lower limit of the joint width of face W does not need to set. This is because the resistance exoergic location in early stages of energization will not vary greatly in the direction of the board width and neither an underheat field nor a fault heating field will be generated in a junction end face, if the joint width of face W fills ** type.
[0031] Moreover, board thickness t1 of sheet steel 1 Board thickness t2 of a steel plate 2 Although not restricted especially, the above-mentioned difference thickness tailored blank material is an object for the circumference components of a guide peg of an automobile, for example, and it is the board thickness t2 of a steel plate 2. When it is 7mm or less, it is the board thickness t1 of sheet steel 1. It is referred to as 1.6mm or more, and is t2 / t1. Carrying out to three or less is desirable. In this case, the buckling distortion of the sheet steel 1 at the time of grant of upsetting-force P can be prevented almost certainly.
[0032] Furthermore, the above-mentioned example is board thickness t1, although it is the case of difference thickness tailored blank material. Board thickness t2 If ** type which the joint width of face W mentioned above is filled also with the case of thick tailored blank material, such as being equal, it cannot be overemphasized that the moldability of the joint is good.
[0033] The tailored blank material of above-mentioned this invention can be manufactured only by the board width Wh of the comparison edge carrying out DC butt welding of the comparison section between the both-ends side to one [at least] steel plate using the thing of the board width which fills the above-mentioned ** type. The comparison end face of both steel plates is enough with the Shache amputation stump side in that case.
[0034] However, when too little [the heat gain at the time of welding / be / it / excessive to remainder or], like the above, an underheat field and a fault heating field are generated in a junction end face, a **** part and the joint on-the-strength fall part by the lack of upsetting occur in it, and a good moldability and the case where it becomes impossible to specifically secure bending workability are in it. Moreover, when the weld time is too long also to remainder, there is a case where in addition to the width of face of heat affected zone 4a becoming large, and a hardened layer width becoming fault size the comparison edge of sheet steel 1 carries out buckling distortion, a normal joint configuration is no longer acquired, and it becomes impossible to secure good bending workability like the above.
[0035] For this reason, an amount is [as opposed to / that heat input total / sheet steel 1] 300A/mm2. To the following and a steel plate 2, it is 25A/mm2. It considers as the above and, as for the weld time, considering as 1 or less second is desirable.
[0036] In addition, in order to obtain the tailored blank material equipped with the joint which shows the moldability which did not stop at simple bending but was excellent also to severer stretch-forming processing or stretch-flanging processing, especially difference thickness tailored blank material, it is good to carry out DC butt welding on the conditions with which above ** - ** type are filled.
[0037] Namely, in order to raise the moldability of a joint 4 further, it is effective, and for that purpose, making width of face (width of face of the comparison direction of heat affected zone 4a) of the hardening layer under welding heat effect as small as possible shortens the weld time S, and it should just narrow the heating range. However, if the weld time S exceeds 0.8 seconds, the width of face of the hardening layer under welding heat effect will become excessive too much, and a moldability will fall on the contrary.
[0038] On the other hand, the amount of welding heat input per unit area of a junction end face is decided by board thickness (t1 and t2), the target joint width of face Wa (= the above-mentioned board width Wh), the weld time S, and the welding current I. Therefore, since the amount of welding heat input per unit area of a junction end face will decrease if the weld time S is shortened, it needs to make the welding current I high. However, in the case of difference thickness tailored blank material, the direct current supplied through electrodes 3 and 3 flows in a steel plate 2 side or this reverse path from a sheet steel 1 side. For this reason, the current density which flows the inside of both the steel plates in a junction end face is I/Waxt1, respectively. And I/Waxt2 Since it asks, it will differ.

[0039] And it is I/Waxt1 in order to secure the near amount of welding heat input of a steel plate 2. The near current density of the sheet steel 1 called for is 250A/mm2. If the welding current I is raised even to the value which exceeds Fault heating of the comparison edge of sheet steel 1 is carried out, the near hardened layer width of sheet steel 1 not only becomes large, but fault heating was carried out, it compares, an edge carries out buckling distortion, the joint 4 of a healthy configuration is no longer obtained, and a moldability falls on the contrary.
[0040] On the contrary, it is I/Waxt2 in order to avoid fault heating of sheet steel 1 certainly. The near current density of the steel plate 2 called for is 100A/mm2. If the welding current I is made low until it becomes the value of the following, the near amount of welding heat input of a steel plate 2 will be insufficient, it will become impossible to secure sufficient joint reinforcement, and a moldability will fall on the contrary.
[0041] For this reason, in order to obtain the joint 4 which has the more excellent moldability, it is desirable to carry out DC butt welding on the conditions with which the above-mentioned ** - ** type are filled. This is clear also from the result of the example mentioned later.
[0042] In addition, for upsetting-force P at the time of welding, that what is necessary is just to decide according to board thickness and the board width, although not set especially, in **, such as carbon steel and low alloy steel, a steel plate is 2 8-20kg/mm per unit area. It is enough if it considers as extent.
[0043]
[Example] Hot rolled sheet steel [that 100-1000mm carried out / 1.6-5.0mm and the board width /, and the end face has carried out / tensile strength / Shache cutting by 370MPa class] was prepared, and board thickness combined with 33 kinds shown in Table 1 and Table 2, compared both the Shache amputation stump sides, carried out DC butt welding on condition that the versatility shown in Table 1 and Table 2, and manufactured difference thickness tailored blank material.
[0044] And the bending trial 5 times the radius of curvature of the board thickness of sheet steel, the ballhead overhang trial with a diameter of 50mm which simulated stretch-forming processing at the time of press forming, and the hole expanding test with a diameter of 10mm which simulated stretch-flanging processing were performed to the joint of the obtained difference thickness tailored blank material, and the moldability of a joint was investigated. In addition, the hole expanding test was carried out also about the base material section of both sheet steel and a steel plate for the comparison.
[0045] About the bending trial, evaluation counted the number of the crack generated in the joint by bending, and each die length, and evaluated them in quest of the percentage which **(ed) the sum total die length of the die length of the generated crack by the joint width of face W (= board width Wh).
[0046] Moreover, about the ballhead overhang trial, the fracture location was checked and the case of fitness "O" and a joint was made into non-** "x" for the case where a fracture location is a base material.
[0047] Furthermore, about the hole expanding test, it asked for the bore-diameter ratio at the crack initiation time to the diameter (10mm) of a hole expanding tool, and fitness "O" and less than 80% of case were evaluated for the case where 80% or more as a result of the lower one of the test results of the base material section of both sheet steel and a steel plate of result is obtained, as non-** "x."
[0048] in addition, the crack generated in the bending test will not carry out visual observation of the fracture surface, and the cause of generating will not depend it on **** by the lack of a heat input -- a heat input -- it combined [whether it is also what is depended on the lack of an upset depended excessively, or], and investigated.
[0049] The above results of an investigation were collectively shown in Table 1 and Table 2. In addition, Sign A has shown the lack of an upset of the above-mentioned crack fracture surface results of an investigation.
[0050]
[Table 1]

表 1

試番	厚鋼板の板厚 t_2 (mm)	薄鋼板の板厚 t_1 (mm)	溶接電流 I (KA)	溶接時間 S (秒)	接合部幅 W (mm)	電流密度 (A/mm²) 厚鋼板側	電流密度 (A/mm²) 薄鋼板側	$\frac{W}{t_2}$	$\frac{W}{t_1}$	試験結果 曲げ試験 割れ率 (%)	試験結果 曲げ試験 波面の調査結果	試験結果 球頭張り出し試験	試験結果 穴拡げ試験	総合評価	区分
1	2.0	1.6	60	0.5	200	150.0	187.5	100.0	125.0	0	−	○	○	◎	本発明例
2			100		300	166.7	208.3	150.0	187.5	0	−	○	○	◎	
3			130		400	162.5	203.1	200.0	250.0	0	−	○	○	◎	
4			180		500	180.0	225.0	250.0	312.5	20	冷接＋A	×	×	×	比較例
5	3.2		60		200	93.8	187.5	62.5	125.0	0	−	×	×	○	本発明例
6					300	62.5	125.0	93.8	187.5	0	−	×	×	○	
7					400	46.9	93.8	125.0	250.0	0	−	×	×	○	
8					500	37.5	75.0	156.3	312.5	30	冷接＋A	×	×	×	比較例
9					600	31.3	62.5	187.5	375.0	60	冷接＋A	×	×	×	
10	3.8	2.0	20	1.0	200	26.3	50.0	52.6	100.0	0	−	×	×	○	本発明例
11			43	0.5	100	113.2	215.0	26.3	50.0	0	−	○	○	◎	
12					200	65.8	125.0	52.6	100.0	0	−	×	×	○	
13			50	1.0						0	−	×	×	○	
14			82	0.5		107.9	205.0			0	−	○	○	◎	

[0051]
[Table 2]

表 2

試番	厚鋼板の板厚 t_2 (mm)	薄鋼板の板厚 t_1 (mm)	溶接電流 I (KA)	溶接時間 S (秒)	接合部幅 W (mm)	電流密度 (A/mm²) 厚鋼板側	電流密度 (A/mm²) 薄鋼板側	$\frac{W}{t_2}$	$\frac{W}{t_1}$	試験結果 曲げ試験 割れ率 (%)	試験結果 曲げ試験 波面の調査結果	試験結果 球頭張り出し試験	試験結果 穴拡げ試験	総合評価	区分
15	3.8	2.0	90	0.5	200	118.4	225.0	52.6	100.0	0	−	○	○	◎	本発明例
16			100	0.3		131.6	250.0			0	−	○	○	◎	
17			120	0.5		157.9	300.0			0	−	×	×	○	
18			125		300	109.6	208.3	78.9	150.0	0	−	○	○	◎	
19			155		400	102.0	193.8	105.3	200.0	0	−	○	○	◎	
20			202		500	106.3	202.0	131.6	250.0	0	−	○	○	◎	
21			250		600	109.6	208.3	157.9	300.0	20	冷接＋A	×	×	×	比較例
22		3.2	100		200	131.6	156.3	52.6	62.5	0	−	○	○	◎	本発明例
23			150		400	98.7	117.2	105.3	125.0	0	−	×	×	○	
24			220		600	96.5	114.6	157.9	187.5	0	−	×	×	○	
25			250		800	82.2	97.7	210.5	250.0	0	−	×	×	○	
26			350		1000	92.1	109.4	263.2	312.5	60	冷接＋A	×	×	×	比較例
27	5.0	2.0	80		200	80.0	200.0	40.0	100.0	0	−	×	×	○	本発明例
28			170		400	85.0	212.5	80.0	200.0	0	−	×	×	○	
29			280		600	93.3	233.3	120.0	300.0	30	冷接＋A	×	×	×	比較例

[0052] As the result shown in Table 1 and Table 2 showed, the crack generated each difference thickness tailored blank material (test numbers 4, 8-9, 21, 26 and 29) of the example of a comparison which separates from the range which the joint width of face W specifies by this invention in the joint in the bending test, the moldability of a joint was bad and, naturally the ballhead overhang test result and the hole expanding test result were also non-**.
[0053] On the other hand, no difference thickness tailored blank material (test numbers 1-3, 5-7, 10-20, 22-25, and 27-28) of the example of this invention whose joint width of face W is within the limits specified by this invention generated the crack at all in the joint in the bending test, but its moldability of a joint was good. Among those, the ballhead overhang test result and the hole expanding test result of the difference thickness tailored blank material (test number 1- 3, 11, 14-16, 18- 20 and 22) of the example of this invention manufactured by the welding condition with which the above-mentioned ** -

** type are filled were also good.
[0054]
[Effect of the Invention] The tailored blank material of this invention is excellent in shaping of a joint, and even if a product is difference thickness tailored blank material, the level difference of the joint does not exceed a board thickness difference. Moreover, since the tailored blank material is obtained only by it being made from a steel plate [that Shache cutting is carried out], and carrying out DC butt welding of the comparison section and it can be manufactured in high efficiency, it can offer a cheap product.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is drawing of longitudinal section showing the welding mode in the case of manufacturing difference thickness tailored blank material by the approach of this invention.
[Drawing 2] It is drawing of longitudinal section showing the longitudinal-section configuration of the joint by which butt welding was carried out.
[Drawing 3] It is drawing of longitudinal section showing the longitudinal-section configuration after reinforcement bead removal of the joint by which butt welding was carried out.
[Drawing 4] It is the top view showing the flat-surface configuration after reinforcement bead removal of the joint by which butt welding was carried out.
[Description of Notations]
1: Sheet steel,
2: Steel plate,
3: Electrode,
4: Joint,
4a: Heat affected zone,
4b: Molten metal coagulation section,
5: Reinforcement bead,
W: Joint width of face.

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CLAIMS

[Claim(s)]
[Claim 1] It is the tailored blank material for press forming to which both steel plates compared and weldbonding was carried out, and is the board thickness of one steel plate t1 It is the board thickness of the steel plate of (mm) and another side t2 Tailored blank material characterized by having the joint width of face W which fills the following ** type when joint width of face after (mm) (however, t1 <=t2) reinforcement bead removal is set to W (mm).
W/t 1 < 300 ... ** -- [Claim 2] Board thickness is t1. The steel plate of (mm), and t2 After comparing both the end faces of the steel plate of two sheets of the steel plate (however, t1 <=t2) of (mm), The manufacture approach of the tailored blank material according to claim 1 characterized by using for one [at least] steel plate the thing of the board width with which the board width Wh of the comparison edge fills the following ** type in case direct-current butt welding of the comparison section is carried out.
Wh/t 1 < 300 ... ** -- [Claim 3] The manufacture approach of the tailored blank material according to claim 2 characterized by carrying out direct-current butt welding of the comparison section on the conditions with which following ** - ** type are filled.
I/Wa xt1 <=250 (A/mm2) ... **I/Wa xt2 >=100 (A/mm2) ... **S<=0.8 ..... ** -- here -- I : The welding current (A)
Wa : target joint width of face after reinforcement bead removal (mm)
S : resistance welding time (second)

[Translation done.]